A minimal representation of turbulence in plane Couette flow
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describe a stochastic structural stability theory (S3T) based model of fully devel-
oped turbulence in plane Couette flow. This model is obtained by partitioning
Navier Stokes into a nonlinear equation governing the evolution of the streamwise
averaged mean flow and a linearized equation for the covariance of streamwise vary-
ing perturbations. When coupled, these equations explicitly model the dynamics of a
second order approximation of the probability distribution of the turbulence. We in-
vestigate this system using a computationally tractable Restricted Nonlinear (RNL)
model that represents the dynamics of a single member of the infinite ensemble of the
S3T system. The RNL system has been shown to capture the dynamics of roll/streak
structures and to support self-sustaining turbulence. Our results demonstrate that
this self-sustaining state naturally collapses to a minimal realization of turbulence
that retains only the essential set of streamwise varying perturbations. Comparisons
to DNS data show that this minimal representation captures the salient features of
fully developed turbulence and that the wavelengths involved in this behavior are
independent of the number of streamwise modes used or the channel length.